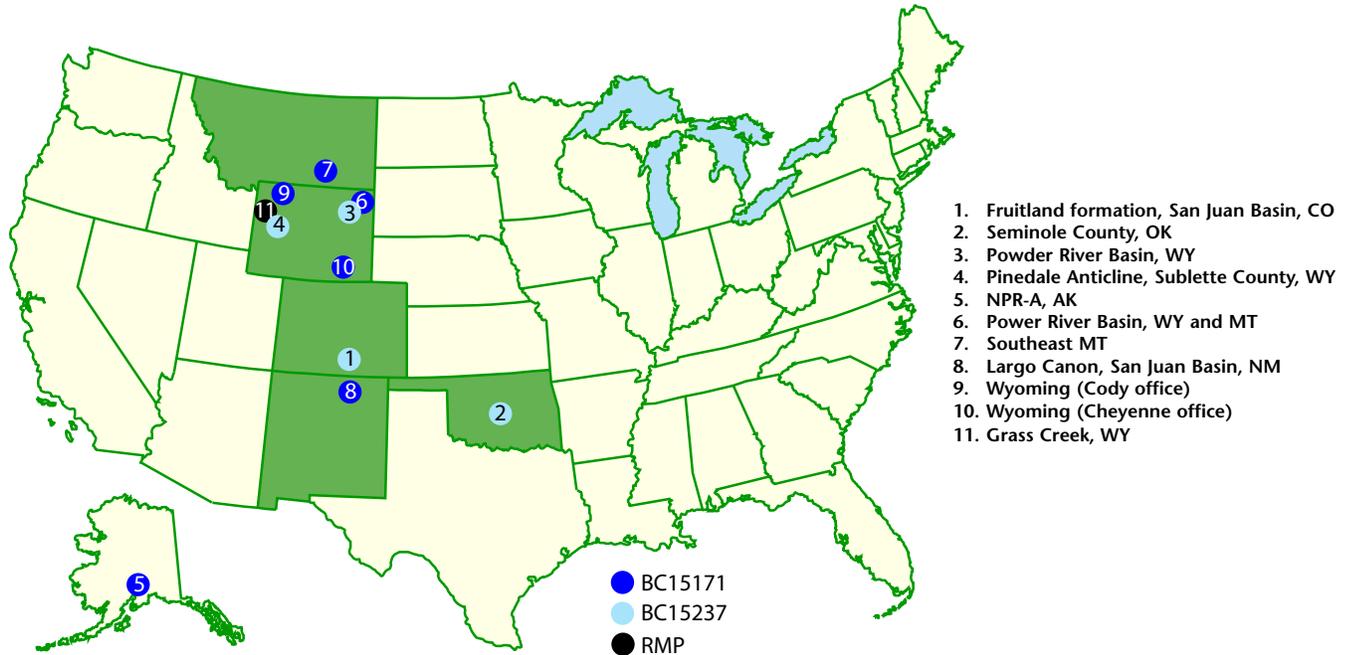


eye on environment

DOE and BLM Working Together to Improve the Environment in the American West



Federal Lands Issue

Winter 2002, Vol. 7, no. 1

This edition of *Eye on Environment* highlights the multiple-use concept of management of Federal Lands:

- Environmental protection
- Economic development



Figure 1. Location map of projects under the DOE/BLM cooperative agreements.

INTRODUCTION

The Bureau of Land Management (BLM) and the Department of Energy (DOE) are working together to protect the environment while supporting the President's goal of increasing domestic oil and gas production. As the primary manager of Federal lands, BLM has the responsibility to balance the many public uses of the land, including oil and gas production, with environmental protection. Because of the need to protect varying interests, a cumbersome system of stipulations, NEPA findings, and permitting requirements has evolved that effectively limit oil and gas development. Many of these stipulations, however, are based on historical industry practices and do not consider current or new innovative industry capabilities to minimize disturbance, protect the environment, and to minimize aesthetic impacts. Other restrictions result from assumptions about environmental protection standards or pollution from oil and gas activities that have never been verified by research.

Under an MOU between BLM and DOE, the National Energy Technology Laboratory's (NETL) Oil and Gas Environmental Program is helping to identify and complete research projects that will help to resolve some of the environmental issues that currently limit oil and gas development on Federal lands. NETL is funding 11 projects (Figure 1) to address concerns ranging from air quality in Alaska, erosional problems in the San Juan Basin of New Mexico to wildlife protection in Wyoming and Montana.

The research projects are grouped under two Interagency Agreements between DOE and BLM, and a joint Resource Management Plan (RMP) in Wyoming. Funding is provided by the DOE with the work performed by personnel from the BLM field offices.

BC 15171

Agreement BC15171 includes four tasks aimed at helping to resolve issues that affect access to Federal Lands for oil and gas operations. These projects identified in **Figure 1** are located in the San Juan Basin of Colorado, Seminole County Oklahoma, north-central Wyoming and, south-western Wyoming. Funding for the four projects is \$485,000 with DOE's share at \$335,000 and BLM's cost-share at \$150,000.

3M Mapping, Modeling and Monitoring of the Northern San Juan Basin, Colorado

The 3M project focuses on assessing the methane seepage impacts related to the downspacing of Fruitland Coalbed Methane (CBM) wells from 320-acre spacing to 160-acre spacing within the Colorado portion of the San Juan Basin. This project was developed to address concerns about the methane seepage at the outcrop related to CBM development and production. Throughout the Fruitland development, there have been reports of increased methane seepage, however no previous concerted effort was made to quantify the seepage rates and tie it to production activities.

The Mapping portion of the project was an effort to map the coalbed outcrops in detail. **Figure 2** shows typical coalbed outcropping of the Fruitland formation. The modeling portion

involved the development of a basin-wide (Colorado and New Mexico) hydrologic model of the Fruitland formation to define pre-development conditions in the Fruitland formation.



Photo credit: Matt Janowiak

Figure 2. Fruitland formation coalbed in roadcut. Note dead trees on top of coalbed. This is an effect of nearby coalbed methane wells dewatering the coalbeds near the outcrop area and increasing the methane seepage at the outcrop.

Four monitoring well clusters are being installed near the outcrop to monitor water level changes associated with CBM development. **Figure 3** shows the monitoring equipment at the Ridges Basin



Photo credit: Matt Janowiak

Figure 3. Ridges Basin monitoring well site. Wellhead is in mesh box, datalogger and telemetry equipment is in shed.

well site. The Colorado Oil and Gas Conservation Commission is in charge of well installation. The three completed well clusters have been fitted with water level dataloggers and telemetry systems for remote access to the data. A fourth will be installed in 2002.

3M results are being used extensively in the development of two programmatic Environmental Impact Statements (EIS) for oil and gas development in the Northern San Juan Basin. Results have enabled land managers to better quantify and analyze impacts associated with coalbed methane development. In general, the 3M study has shown that, although methane seepage will increase, the surface impacts will be confined to areas of the outcropping coalbeds (**Figure 2**).

Impact: By allowing investigators to quantify and analyze impacts, decisions for future development of coalbed methane resources will be highly defensible. Contact: Matt Janowiak, Durango BLM Office (970) 385-1362.

Brine Impact on Aquifers in Seminole County, Oklahoma

The project is an investigation of the effects of brine leakage from historic oil reservoirs on aquifer quality. Researchers from the University of Tulsa are using a combination of field sampling of streams and rivers, and water wells. The Project will develop a gradient flow model, achieve point source determination and make recommendations concerning how to remediate impacts of brine pollution.

The initial investigation used Differential Global Positioning Satellite (GPS) technology to locate samples and Geographic Information Systems (GIS) to analyze the spatial relationships of the samples to oil and gas fields. The data collected during the 2001 summer field season included: the location of the sampling sites, sample collection, development of the gradient flow model for the aquifer, and location and production history of oil and gas fields in Seminole County, Oklahoma.

A water probe was used to measure dissolved O₂, conductivity, salinity, temperature and pH from 155 samples initially collected. Ground water sampling will continue in the spring of 2002. **Figure 4** shows typical damage from brine leakage in the semi-arid Seminole county.



Photo credit: Laura Whitesell, University of Tulsa

Figure 4. Soils damaged by brine spill in rural Seminole County, OK.

All current and historic oil and gas wells have been integrated in the GIS model. Both oil and new gas and oil tanks have been mapped, and the property of map of Seminole County has been scanned for inclusion in the GIS model. Logs for water wells are being used to determine the top of the water table throughout Seminole County to model the aquifers.

Impact: Modeling of the ground water flow will aid the goal of planning remediation and preventing future damage to aquifers. Contact: Sandford Wells, BLM Tulsa, OK (918) 621-4141, Brian Tapp, University of Tulsa (918) 631-2517.

Coal Bed Methane Water Quality Monitoring in Wyoming

Since 1992 the Bureau of Land Management has been involved with the development of the coal bed methane resources in the Powder River Basin of Wyoming. Development started at a rate of approximately fifty wells per year and currently the proposed development is projected to exceed 50,000 wells by 2010 (**Figure 5**). The public's pri-



Photo credit: Mike Brogan

Figure 5. Coalbed methane drilling site in the Powder River Basin, WY.

many environmental concerns revolve around the impacts to the water resources in the Powder River Basin, which is the responsibility of BLM.

Due to the lack of specific data on the effect of coalbed methane development on water quality, the BLM initiated a monitoring plan and developed specialized equipment (Figure 6). The primary objectives of the monitoring effort were to insure that the completion procedures used on methane production wells were adequate to minimize inter-aquifer communication and protect the water quality and availability in aquifers adjacent to the methane target aquifers.



Photo credit: Mike Brogan

Figure 6. Water quality monitoring equipment.

The project consists of the following sub tasks: 1) drilling and casing of four sets of water monitoring wells, 2) logging wells to evaluate cement

integrity, 3) pump testing to quantify communication, and 4) installation of solar powered monitoring equipment. Figure 7 depicts a hypothetical (but realistic) geologic setting and the associated “nest” of monitoring wells.

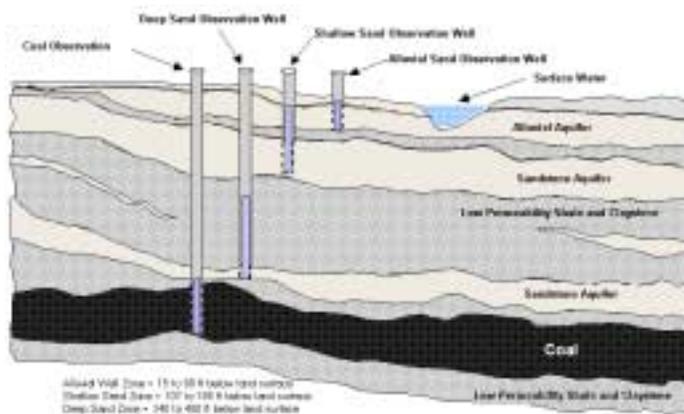


Photo credit: Mike Brogan

Figure 7. Schematic of monitoring well nest showing completion depths and monitoring sites.

Impact: The cooperative DOE /BLM project initiated in 2001 includes the enhancement of an ongoing ground water monitoring effort to investigate the effectiveness of casing and cement procedures in wells in Powder River Basin coal bed methane fields. Continued monitoring of water quality and improved technologies for handling ground water will ensure protection of streams and land in the Powder River Basin. Contact: Mike Brogan, BLM Caspar Field Office (307) 261-7640.

Effects of Oil and Gas Development on Sage Grouse, in SW Wyoming

This project is an evaluation of the impacts of oil and gas exploration, development and production on sage grouse populations on breeding grounds. The current project is part of ongoing research dating back to the mid-1990s. Figure 8 shows the typical sagebrush habitat of the area and a sage grouse hen nesting. The study area near Pinedale, Wyoming is in the Jonah I and II natural gas fields, an area that has recently seen significant increased development. Full field development is expected to continue for the next 10 to 15 years.

The study is designed to assess impacts, if any, of common oil field activities (i.e. noise, lights, human foot and vehicular traffic, etc) on the breeding activities of sage grouse. Sage grouse went through a marked decline in the early part of the 20th century. The hunting season was closed from 1937 to 1948 to allow the population numbers to increase. Sage grouse numbers rebounded during this interval, but were declining again by the early 1990s. Recent studies have attempted to assess the population in terms of risks posed by human activities other than hunting. Many activities other than hunting, including oil field activities, can be regulated by seasonal use patterns, which can significantly reduce the impact on the sage grouse breeding population.



Photo credit: Matt Holleran

Figure 8. Sage grouse hen on nesting site, Pinedale Anticline, Sublette Cty., WY.

The 80,000 acre study area in Sublette County, Wyoming is dominated by sagebrush and high-desert vegetation. The BLM manages 80% of the area, 15% is privately owned and 5% is managed by the state. Eleven sage grouse leks, or male strutting ground/breeding areas (Figure 9), within the study area were selected dependent on location (to ensure logistic feasibility), and drilling activity potential. Field development is concentrated within 5-km of the crest of the Pinedale Anticline, but “hot spots” outside this zone may also be developed. BLM has leased all but 19 km² of the area for potential development.

The study will compare differences between areas where natural gas disturbance potentially influences sage grouse behavior, and areas where there is no gas related disturbance. The habitat use data will be used to develop a map of sage grouse seasonal ranges along the Pinedale Anticline. The sage grouse distribution map can be overlaid onto potential drilling site maps, vegetative cover maps, and used to determine which seasonal period could potentially be impacted, where critical habitats exist, etc.



Photo credit: Matt Holleran

Figure 9. Sage cock strutting on lek during the breeding season, Pinedale Anticline, Sublette Cty., WY.

Specific questions of concerns to be addressed by the study concern the potential affect of drilling activities within a given distance from a lek during the breeding / incubation seasons on nesting behavior, incubation, brood habitat selection and ultimate reproductive success. The oil field activities being analyzed include; drilling, storage tanks, road construction and use, transmission lines, and fragmentation of the habitat by oil field activities.

Impact: The study will provide land managers with the tools necessary to initiate drilling regulations that minimize adverse effects to breeding sage grouse while maintaining oil field development.

Contact: Dave Roberts, BLM Cheyenne Field Office (307) 775-6099; Matt Holloran Wyoming Cooperative Research Unit (307) 766-5415.

BC15237

Agreement BC15237 is focused on research to improve access to Public Lands for oil and gas operators. Project sites (**Figure 1**) are the National Petroleum Reserve in Alaska, Powder River Basin Wyoming, Largo Canon in the San Juan Basin of New Mexico, southeastern Montana, and two state-wide management projects in Wyoming. Funding for the interagency agreement is \$650,000 with DOE's share being \$500,000 and the Bureau of Land Management's cost-share being \$150,000.

Air Monitoring in National Petroleum Reserve Alaska

The study will focus on the impact of oil development activities on airborne contaminants in watersheds of Northeast Alaska (NPR-A). DOE funds will be used to expand the number of index sites in an existing BLM airborne contaminants study. The goal is to further increase scientific understanding of the levels, distribution and temporal trends of air deposition on contaminants associated with petroleum activities in the NPR-A study area.

Impact: This study will result in greater understanding of current land conditions, and will provide for protection of environmental quality. This knowledge will be used to ensure sustainable utilization of natural resources, including use by the indigenous people of the Alaskan Arctic. Contact: Susan Flora, BLM Anchorage Field Office (907) 474-2303.

Evaluation of Effects of Soils by Produced Water from Coalbed Methane Operations, Powder River Basin, Wyoming and Montana

It is estimated that there is over 25 trillion cubic feet (tcf) of recoverable Coalbed methane gas (CBM) in the Powder River Basin of Wyoming. CBM is a major economic resource, and a major natural resource management issue in Wyoming and Montana. Currently there are over 4,000 CBM wells producing in the Powder River Basin, and estimates predict over 50,000 CBM wells will be drilled by the year 2012.

On average, CBM wells in the Powder River Basin yield about 10 gallons per minute (gpm) of produced water. Most CBM produced water in the Powder River Basin is currently surface discharge to impoundments, or local stream channels (**Figure 10**). Recently concerns have been raised regarding the salinity and sodium concentrations of some CBM produced water, and the potential impact of this water on downstream irrigation. In response to water quality concerns, methane producers have developed a significant interest in alternative water management techniques, including land application of produced water (**Figure 11**).



Photo credit: Joe Meyer

Figure 10. CBM produced water discharge point and collection pond with center pivot sprinkler in background, Powder River Basin, WY.

With the estimated production life of a CBM well at 7 to 10 years, there is potential for CBM product water to cause salinization, sodicity and sedimentation. Good water management practices make it essential to evaluate the consequences of application of CBM product waters on the soils, vegetation and stream channels within the Powder River Basin.

Field studies will evaluate soil and CBM water chemical and physical parameters that are important to the proper management of these resources. Laboratory and greenhouse studies will use soils collected from the field sites that are characteristic of areas that may be used for irriga-



Photo credit: Joe Meyer

Figure 11. Land application of CBM produced water, Powder River Basin, WY.

tion or water disposal. Both soils and waters will be characterized in the field and laboratory for chemical and physical properties essential to understanding how land and water management practices may be influenced through the use of CBM product waters.

Irrigation using CBM produced water will be examined by evaluating existing data on soil physical and chemical properties, and agricultural crop and forage grass yields. The impacts due to irrigation and/or disposal of CBM produced waters will be evaluated through studies on soil chemical properties (soil pH, soil salinity, accumulation of major, minor and trace elements, sodium adsorption ratio, electrical conductivity, etc) and soil physical properties (soil drainage properties, soil texture, etc.). Potential physical and chemical methods (adsorption, precipitation, etc.) to remove contaminants from CBM-produced water will be studied.

The main objective of this study is to determine the probable short and long-term affects of CBM water on agriculture, vegetation, and soil chemical, physical and microbial properties. The expected results and benefits of this project include data on the fate and transport of soluble salts in the soil profile, changes in chemical and physical soil properties, and acceptable application technologies and rates of CBM product waters (Figure 12).



Photo credit: Joe Meyer

Figure 12. CBM produced water discharge using mobil atomizer tower, Powder River Basin, WY.

Impact: Data will be used to develop interpretive guidelines specific to the application of produced water that could be used by regulatory agencies and methane producers to aid in developing land application systems for the purpose of irrigation or land disposal. Emphasis will be placed on the development of GIS based tools to automate study results **Contact:** Joe Meyer, BLM Casper Field Office (307) 261-7641, Drs. George Vance and Larry Munn, The University of Wyoming.

Erosion Study in Largo Canñon Watershed, San Juan Basin, New Mexico

Oil and gas production in the Largo Canñon Watershed and surrounding area began in the 1940s. By the late 1980s an extensive network of dirt roads have been constructed to service the oil and gas pumping well in the Navajo Reservoir area of the San Juan Basin. There are approximately eight wells per square mile and the density is expected to increase over the next few decades.

Most of our knowledge about erosion from dirt roads comes from watershed studies conducted in National Forests, most were done in humid-temperate regions. In the southwest, few studies

have documented or quantified road erosion.

The Water Energy Prediction Project (WEPP) is a model developed by the U. S. Department of Agriculture to show spatial and temporal estimates of erosion and deposition. The model will be adapted and used to estimate hillslope erosion in the Largo Canón Watershed. The project will collect rainfall, runoff and sediment deposition for a period of 2 years at selected sites in Largo Canón. Photogrammetric analysis of Largo Canón from the 1930s to the present will be incorporated into GIS and modern aerial photo surveys. Several Federal agencies are involved in collecting the necessary data. USGS personnel will interpret The GIS map data, Soil data will be obtained from STATSCO, and BLM will provide information on grazing intensity. Collection sites on roads will include both oil field and grazing areas. Runoff measurement over time will provide quantification of the sediment eroded.

The Largo Canón area has little or no undisturbed or pristine areas to measure natural erosion. Relatively undisturbed sites will be selected for control erosion measurements. These sites have low livestock densities and few dirt roads.

Impact: The study will provide much needed information of erosion from dirt roads, grazed areas and natural background rates of erosion. Data will be used to implement erosion-control strategies while providing for the orderly development of oil and gas reserves to meet the nation's energy demands. Sediment yields quantified from this study will be used to determine how applicable the WEPP model is for the Southwest. BLM will be able to apply results of this study to similar areas in the Southwest. Contact: Dale Wirth, BLM Farmington Field Office (505) 599-6320.

Effect of Coalbed Methane Development on Wildlife and Wildlife Habitat in Southeast Montana

This project is designed to assess the impacts of coalbed methane development on wildlife habitats in southeast Montana. Some specific coalbed methane development activities that could

impact wildlife and wildlife habitats include: power lines, roads, transportation systems, traffic, and noise. The assessment will determine the effects of coalbed methane development on big game winter range, fawning and calving habitat, sage grouse breeding habitat and raptor nesting habitat. Plans for telemetry collars on deer will be used to track seasonal usage in the study area.

Impact: The results of this project will be used to determine and recommend the best management practices for mitigation of the impacts of coalbed methane development on wildlife species and their habitats in southeast Montana. Contact: Larry Rau, BLM Billings Field Office (406) 233-2500.

Comprehensive Conditions of Approval (CCOAs) for Improved Management of Oil Fields in Wyoming

The CCOA concept views drilling, production and reclamation as a continuum of field practices that can be systematically codified and analyzed in single document, the CCOAs. The focus of the grant is to determine the efficiency of the approach and verify the ability to sustain court challenge from operators or environmental groups. These are legitimate questions that impede wider acceptance of the CCOA concept.

The initial objective of CCOAs was to save time. When they were being developed, the CCOAs were employed on limited basis until proven effective. In each case, timesaving at one stage allowed the next stage to be applied more efficiently to the next field. Termed guidelines, the concept down played regulation and emphasized cooperation with industrial partners who possessed high levels of environmental competence. Because permits could be processed promptly with little effort, customer service improved significantly.

Timesaving allowed cooperation on new fronts. Old electrical structures that had been installed without raptor (birds of prey) proofing were modified and raptor electrocutions were cut in half. Operations were restructured so more than 85 small pits could be reclaimed. A small program-

matic environmental assessment, that focused on routine flow lines, roads, power lines and other activities, was completed greatly reducing the time for processing these actions.

At about the same time a more aggressive federal regulatory posture was becoming evident both inside and outside the Bureau of Land Management. In this environment the CCOAs came under skeptical scrutiny. The main concerns are enforceability, NEPA adequacy and doubts about improved efficiency.

Enforceability - Conditions of approval must have the legal power to enforce necessary environmental management and assessments if necessary. To answer these concerns, the format has tightened up to reflect a more regulatory tone. The name has been changed from "Guidelines" to "Comprehensive Conditions of Approval (CCOAs)".

Compliance With the National Environmental Policy Act (NEPA) - Operators plan of development relies heavily on references to appropriate sections of the CCOA. Additional, site-specific mitigation can be added to solve problems identified in environmental analyses.

Effectiveness - The staff and management of both industry and government believe that CCOAs cut paperwork and time spent of permitting in half.

Impact: By affirming these issues and methods the research validates the CCOA concept so that it can be continue to be employed with confidence and tried in other offices. **Contact:** Vic Seefeldt, BLM Cody Field Office (307) 578-5918.

Inventory of Ammonia for Wyoming

The ammonia inventory involves compiling and reviewing all available data on ammonia sources distributed throughout Wyoming. Previous research on ammonia source strings that have been documented in the scientific literature will be used. The ammonia inventory data is being mapped, and the grid map will be used to develop an air quality model for Wyoming.

Impact: The goal is to determine the sources of ammonia and their affect on visibility and air quality throughout the inter-mountain west. The amonia inventory represents an essential first step to indentify amounts and sources of ammonia pollution so that remediation steps can be planned. **Contact:** Susan Capland, BLM Cheyenne Field Office (307) 775-6031.

RMP

Grass Creek Resource Management Plan

The Grass Creek area includes parts of Big Horn, Hot Springs, Park, and Washakie counties in northwestern Wyoming. BLM is responsible for developing a resource management plan for these federally owned lands. The resource RMP will serve as the basis for all activities (including oil and gas operations) that occur on BLM administered grounds at Grass Creek. The RMP will help define whether or not certain activities will be allowed, where activities will be allowed, and under what conditions.

BLM's Wyoming State office has developed a website on the Grass Creek RMP. The primary objectives of developing a web-based platform include providing (1) widespread access to current versions of the RMPs and their supporting data and (2) a streamlined method for maintenance of the RMP. The petroleum industry will benefit from adoption of a web-based RMPs methodology through easy, direct access to the current version of the RMP text, and to current resource decisions that could impact future exploration and development activities. If successful the Wyoming State BLM office will transfer data from all 13 RMP areas to the web-based platform. The website is being developed by Argonne National Laboratory's Environmental Assessment Division, with funding from the DOE's National Petroleum Technology Office in Tulsa, Oklahoma.

Impact: Streamlining the process for documenting maintenance of the RMP by BLM will remove delays and increase industry's ability to plan in accordance with approved practices. Ultimately, implementation of RMP's will reduce costs, increase efficiently in the permitting process and

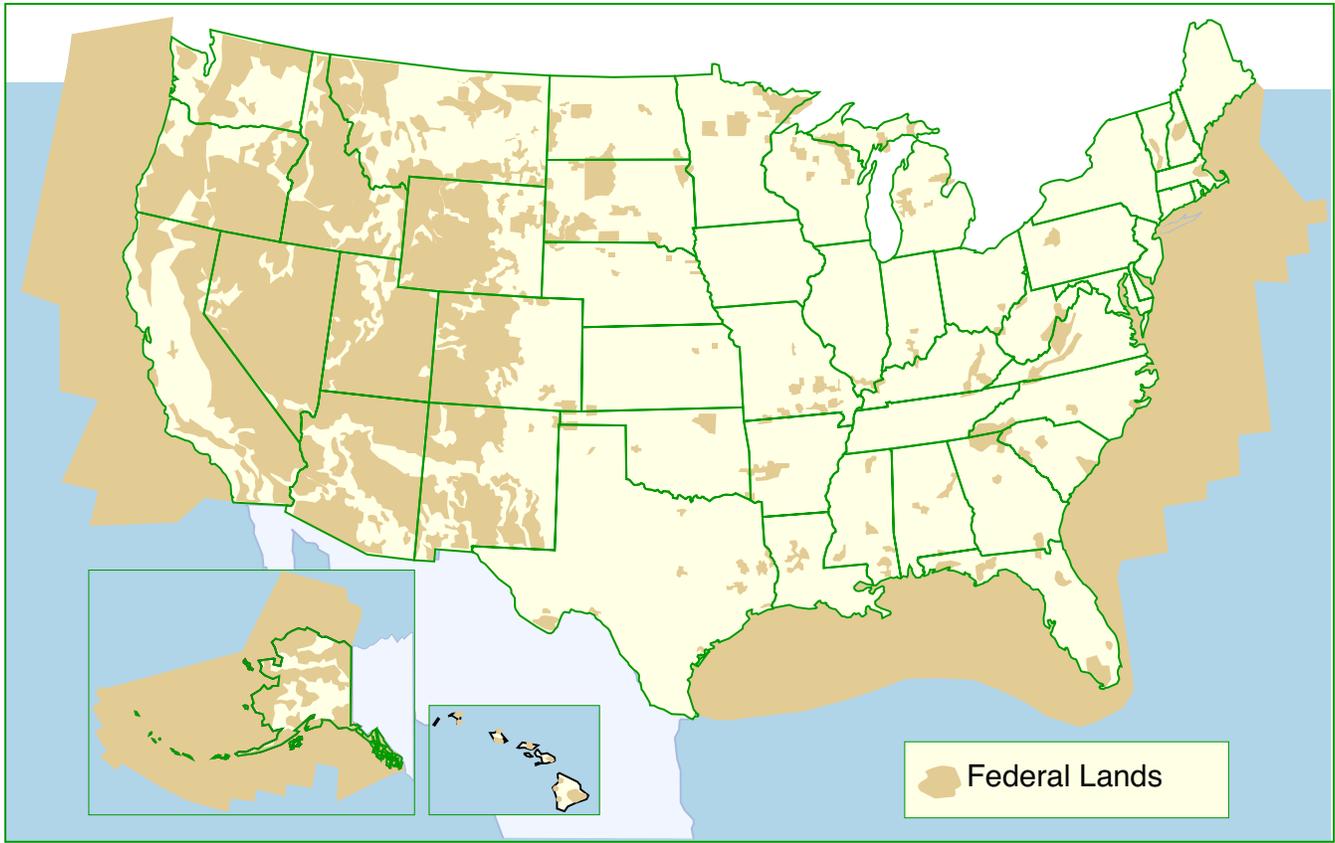


Figure 13. Federal lands produce one-fourth of the Nation's oil.

improve information access. **Contact:** David Alleman, (918) 699-2057; Karen P. Smith, Argonne National Laboratory (303) 986-1140.

Summary

BLM and DOE share the responsibility of safe guarding Federal Lands for multiple use to benefit the public. The projects issued are scheduled to run for 24 months. The four projects under Agreement 15171 began in August 2000 and will be completed in June 2002. Since they are further along the project investigators could supply more details and discuss the initial successes of their research. The six projects under Agreement 15237 began in August 2001 and will continue to August 2003. The information under several of these projects focus on plans and initial start-up work.

The benefits of the research projects funded by DOE and BLM may have wide reaching results. DOE's contribution will ensure that energy needs

are given consideration along with environmental protection of Federal Lands (**Figure 13**). Ultimate goals of both agencies are to promote protection of environment resources (air, water, land, wildlife) and to maintain the economic uses of the Federal Lands.

The common theme is all the projects is to identify both the elements from oil and gas development, which may cause damage; and the specific environmental water, air, soil or wildlife parameters, which require protection. Technologies are being developed for continued monitoring of conditions, and results will be used to plan protection of the environment and regulate oil and gas development for the benefit of the public. As Federal Lands contribute one quarter of all the oil and gas produced in the United States, it is vital that this resource is properly managed. DOE's participation in these projects is recognition of the value of the energy produced and the need to continually ensure that Federal Lands are protected. 



EoE features oil- and gas-related projects implemented through DOE's oil and gas environmental research program.

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May

**16-17, DOE Alaska Workshop, "Reducing the
Effects of Oil and Gas Exploration and
Production on Alaska's North Slope: Issues,
Practices, and Technologies", Anchorage, AK.**
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